

#### REMARKS

Non-elected claims 1-6 are canceled.

Claims 7-16 are rejected under 35 U.S.C. § 103(a) as being unpatentable over the applicants' admitted prior art (AAPA) of this application in combination with Mercaldi (U.S. Patent Application Publication Number US 2003-0073308). In view of the following remarks, the rejections are respectfully traversed, and reconsideration of the rejections is requested.

In accordance with the applicants' invention, a gate pattern 110 includes a gate electrode 102, a silicide layer 104, a nitride film 106 and a gate spacer 108 formed on a substrate 100. The nitride film 106 and gate spacer 108 are formed using low-pressure chemical vapor deposition (LPCVD). An etch stopper layer 120 covers the gate pattern 110 and the substrate 100. The etch stopper includes a second nitride film which is formed using low-temperature atomic layer deposition (ALD). An interlayer insulating film 130 is formed over the etch stopper. A self-aligned contact hole is formed by dry etching the interlayer insulating film. During this dry etch, the etch stopper 120, which includes the second nitride film, prevents etching of the silicide layer 104 and the gate electrode 102. It also prevents damage to the semiconductor substrate 100. The etch stopper layer 120 can then be removed by performing wet etching. The wet etching does not damage the top of the substrate 100. Wet etching can be used to remove the remaining etch stopper layer 120 because the layer 120 is formed of a nitride film using low-temperature ALD. This is in contrast to the prior art structure illustrated, for example, in Figure 1 of the application, in which the etch stopper film 30 is a nitride film made using low-pressure chemical vapor deposition. Because the film is formed by LPCVD, it is removed in the prior art method during a dry etch. This tends to etch the substrate 10, which can cause damage, as shown in Figure 2 of the application.

Hence, in accordance with the application, the etch stopper layer 120 is a nitride film formed by low-temperature ALD, such that it can be removed using wet etching, as opposed to dry etching. This results in reduced damage to the device substrate.

The Examiner notes correctly that the AAPA teaches an etch stopper layer 30 comprising a nitride film formed by low-pressure chemical vapor deposition, and fails to teach an etch stopper formed by low-temperature atomic layer deposition, as set forth in the applicants' claims. The

Application Number 10/612,028  
Amendment dated July 2, 2004  
Reply to Office Action of April 6, 2004

Examiner then cites Mercaldi as teaching a nitride film formed by low-temperature atomic layer deposition. The Examiner states that it would have been obvious to one of ordinary skill in the art to form an etch stopper made of nitride by low-temperature atomic layer deposition to obtain the advantages of nitride having low electrical tunneling probability and low defect densities. The applicants respectfully disagree that one of skill in the art would be motivated to make the cited combination.

Referring to page 6, paragraph [0050] of Mercaldi, formation of silicon nitride is taught as a capacitor dielectric on a storage node layer. Formation of silicon nitride on a BPSG layer is also taught as a dopant diffusion barrier. Mercaldi also notes that formation of silicon nitride as a capacitor dielectric by ALD offers the advantage of a thin capacitor layer that possesses low electrical tunneling probability and low defect densities compared to traditional CVD silicon nitride. The Examiner cites this statement as a motivation for combining the AAPA with Mercaldi. However, the applicants respectfully submit that there would be no motivation to make such a combination to one of skill in the art. Mercaldi explicitly teaches that formation of a silicon nitride layer by ALD provides performance advantages for the completed capacitor device, such as the low electrical tunneling probability and low defect density. However, the AAPA teaches the nitride layer formed by LPCVD being an etch stopper layer, which is eventually removed by dry etching. That is, the etch stopper layer 30 of the prior art is completely unrelated to performance of a completed device. It is used merely as an etch stopper layer during dry etch formation of a contact hole. The etch stop layer is eventually removed from the device. Therefore, the layer has nothing to do with performance of the device and, therefore, one of skill in the art would have no motivation whatsoever to make the cited combination. With regard to the specific motivation pointed out by the examiner, one of skill in the art would have no need to use the ALD taught by Mercaldi to obtain the performance advantages cited, since the etch stopper layer of the AAPA is not related to performance of a device and is removed during the fabrication process anyway.

The lack of motivation to combine the cited references is particularly clear when one considers the disparate technologies to which the references are related. The AAPA is related to an approach to fabricating a self-aligned contact hole between gate electrode structures. The approach

Application Number 10/612,028  
Amendment dated July 2, 2004  
Reply to Office Action of April 6, 2004


employs an etch stopper layer to facilitate the fabrication procedure, namely, to prevent etching of the gate structures while the contact hole is formed. In contrast, Mercaldi is directed to a capacitor structure. The Mercaldi nitride layer at issue here is used as a capacitor dielectric or a diffusion barrier layer. The layer is formed by ALD to obtain certain advantages in the performance of the capacitor device. One of skill in the art in possession of the teaching of the AAPA would not be motivated to combine it with the teaching of the Mercaldi nitride layer, since the etch stopper layer of the AAPA is a layer used to facilitate fabrication and is not present in the final device, so the performance advantages of the Mercaldi nitride layer would be irrelevant.

For at least the above reasons, one of skill in the art would have no motivation to make the cited combination of the AAPA with Mercaldi. In particular, the person of ordinary skill in the art would not be motivated to combine the AAPA with the teachings of Mercaldi in order to obtain the performance advantages taught by Mercaldi, since the etch stopper layer of the AAPA is used primarily during fabrication and is generally unrelated to performance of the final device. Since one of skill in the art would not be motivated to make the combination and since neither of the references suggests any motivation for making the combination, it is believed that the rejection of the claims under 35 U.S.C. § 103(a) is improper, and reconsideration of the rejections of claims 7-16 under 35 U.S.C. § 103(a) based on the AAPA and Mercaldi is requested.

In view of the amendments to claims and the foregoing remarks, it is believed that all claims pending in the application are in condition for allowance, and such allowance is respectfully solicited. If a telephone conference will expedite prosecution of the application, the Examiner is invited to telephone the undersigned.

Respectfully submitted,

Date: October 5, 2004  
Mills & Onello, LLP  
Eleven Beacon Street, Suite 605  
Boston, MA 02108  
Telephone: (617) 994-4900  
Facsimile: (617) 742-7774  
J:\SAM\0421\amendmenta.wpd

  
Steven M. Mills  
Registration Number 36,610  
Attorney for Applicants